

**Edison SmartConnect Program
P2 – Customer Connects Plug-In Electric Vehicle (PEV)
to Premises Energy Portal**

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**SmartConnect Use Case:
P2 – Customer Connects Plug-In Electric Vehicle (PEV) to Premises
Energy Portal**

January 22, 2009

Document History

Revision History

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Approvals

This document requires following approvals.

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Use Case Description

1.1 Use Case Title

Customer Connects Plug-in Electric Vehicle (PEV) to a Premises Energy Portal

1.2 Use Case Summary

Consumer interest in electric vehicles is on the rise and all electric vehicles (EV) and plug-in electric vehicles (PEV) are becoming the transportation of choice. Electric utilities hope to support these emerging loads by encouraging charging these vehicles at off-peak times when energy costs are low and generation and power delivery assets are underutilized. PEV manufacturers are interested in working with utilities to develop customer rates/programs that provide customers with greater incentives to purchase an EV or PEV.

Within a utility service territory the customer can plug in a PEV to receive a charge of electrical energy at his premises or plug in at another premises location. The utility may offer the customer a PEV tariff that provides a lower rate for off-peak charging and a higher rate for on-peak charging. Each time a PEV is charged, customers enrolled in a PEV program, exchange account and energy information with the utility. Energy supplied to the PEV is then reported to the utility for billing and presentation to the customer.

1.3 Use Case Detailed Narrative

Upon plugging a PEV into an energy portal (120V or 240V), a communications session is initiated between the local Energy Services Communication Interface (ESCI) located at the premises and the energy portal on board the charging PEV, authenticating customer and PEV I.D. The utility confirms both are enrolled in a valid PEV program and that the ESCI and the energy portal belong to the same account. Once the account has been verified, PEV charging begins and an End Use Measurement Device (EUMD) tracks the amount of electricity supplied during the session. If communications cannot be established, or if a PEV fails validation, charging will continue, but no special PEV incentives will apply. Upon termination of the charging session, the EUMD logs the charging session information and reports the data to the utility for billing and presentation to the customer. This use case covers five scenarios:

- 1) Customer connects PEV to energy portal at their own premises
- 2) Customer connects PEV to energy portal at another premises and that premises customer pays for the energy used
- 3) Customer connects PEV to energy portal at another premises and the PEV customer pays for the energy used
- 4) Customer connects PEV to energy portal at another premises outside the enrolled utility's service territory

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- 5) Non-enrolled PEV (or Customer with non-communicating PEV) connects PEV to the energy portal

Situations related to public charging are detailed implicitly in Scenarios 2 and 3. Apartment building/multi-tenant situations can be covered by scenarios 1, 2, or 3.

1.4 Business Rules and Assumptions

- Foremost, the PEV and utility have communications capabilities. For a foreign utility scenario (Scenario 3.4) it is assumed the roaming utility also has communications capabilities.
- In the absence or failure of PEV-utility communications, or if PEV I.D. validation fails, PEV charging will always proceed, but without the incentive rates and with all energy charges accruing to the premises customer according to that customer's default rate/service plan.
- The PEV charging process for this use case can only be applied to customers that have already enrolled in a utility PEV program and have registered one or more PEVs in advance of charging. The enrollment and initial registration scenarios are covered in Use Case P1. Steps for repeat binding of PEV to premises are also covered in Use Case P1.
- The EUMD is available for PEV charging. If not available, charging will proceed without incentive rates and with all energy charges accruing to the premises customer.
- The EUMD function can be inclusively located anywhere in a zone from the PEV and the branch circuit panel connection.
- Un-enrolled PEV are prohibited from binding to utility devices or networks (ESCI); however, PEV charging will be able to proceed with the assumptions already documented.
- The foreign utility scenario (Scenario 3.4) assumes the existence of a cross-utility clearinghouse, available to all utilities that can reconcile roaming PEV charging between a premises customer of one utility and the PEV operator/customer of a different utility. The concept of portability for multiple utility customers with separate utility accounts across a given PEV on a regular basis (e.g., rental car scenario) is not explicitly considered in this use case, but may be covered in a future use case.

2. Actors

Describe the primary and secondary actors involved in the use case. This might include all the people (their job), systems, databases, organizations, and devices involved in or affected by the function (e.g. operators, system administrators, customer, end users, service personnel, executives, meter, real-time database, ISO, power system). Actors listed for this use case should be copied from the global actors list to ensure consistency across all use cases.

<i>Actor Name</i>	<i>Actor Type (person, device, system etc.)</i>	<i>Actor Description</i>
Customer	Person	The operator of a plug-in electric vehicle (PEV) and a customer of the home electric utility. Has enrolled in the utility's PEV program and has selected a PEV rate tariff. Responsible for connecting the PEV to an energy portal for charging.
Plug-in Electric Vehicle (PEV)	System	Mode of transportation that plugs into an energy portal at a charging premises. The vehicle is capable of two-way communications with the utility through the Energy Services Communications Interface (ESCI).
Energy Portal	Device	Any charging point for a PEV. At a minimum, it is a 120V, 15A outlet, but can be a 240V Electric Vehicle Supply Equipment (EVSE) outlet connected to the premises circuit.
Utility	Organization	A generic term referring to the collection of systems, business functions, and organizations that form an electric utility organization. The term is used whenever the precise actor is not known or many actors utilize a service.
Energy Services Communication Interface (ESCI)	System	System that communicates with and exchanges information between utility, PEV, and End Use Measurement Device (EUMD). Provides PEV charging session information (PEV I.D., interval kWh consumption) to the utility and passes energy information, including price signals, schedules, event messages, configuration, and security data from the utility to the PEV. This interface may or may not be facilitated by an Advanced Metering Infrastructure (AMI) that includes a Home Area Network (HAN).
End Use Measurement Device (EUMD)	Device	Measures and communicates energy usage information payload to Energy Services Communication Interface (ESCI). Provides charging session information such as PEV I.D. and interval kWh consumption from PEV to utility. Receives configuration information (e.g., interval for metering kWh consumption) from utility.
Electric Vehicle Supply Equipment (EVSE)	Device	The physical electrical cord and connectors specified by applicable SAE standards (e.g., SAE 2293, SAE 1772, SAE J2836, etc.) to transfer electrical energy from energy portal to PEV. Can be 120V or 240V AC depending upon type and size of energy portal. May or may not have EUMD and/or ESCI communications capability.

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<i>Actor Name</i>	<i>Actor Type (person, device, system etc.)</i>	<i>Actor Description</i>
Roaming Utility	Organization	Electric Service Provider that supplies energy to a PEV when it is outside of the customer's utility service territory.
Clearinghouse	Organization	Handles global PEV account services. Maintains the information necessary to facilitate account validation and billing transactions while a customer charges a PEV at a location other than the one they are enrolled with.

3. Step-by-Step Analysis of Each Scenario

Describe steps that implement the scenario. The first scenario should be classified as either a primary scenario or an alternate scenario by starting the title of the scenario with either the word “Primary” or “Alternate”. A scenario that successfully completes without exception or relying heavily on steps from another scenario should be classified as Primary; all other scenarios should be classified as Alternate. If there is more than one relevant scenario (set of steps) make a copy of the following section (all of 3.1, including 3.1.1 and tables) and fill out the additional scenarios.

3.1 Primary Scenario: Customer connects PEV to energy portal at their premises location

This scenario details the most common situation, a customer charging their PEV at their own premises. As described in the Narrative section, the customer is attempting to charge a PEV under a selected PEV rate tariff that provides incentives for charging their vehicle during off peak periods.

<i>Triggering Event</i>	<i>Primary Actor</i>	<i>Pre-Condition</i>	<i>Post-Condition</i>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the steps</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
<i>The customer plugs a PEV into an energy portal.</i>	<i>PEV</i>	<i>Customer has enrolled PEV with their home utility.</i>	<i>The utility has a record of energy purchased transactions related to the customer premises and the associated PEV I.D.</i>

3.1.1 Steps for this scenario

Describe the normal sequence of events required to complete the scenario.

<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
<i>#</i>	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	Customer	Connects PEV to energy portal at own premises.	

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<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
2	PEV and ESCI	Performs PEV binding and authentication process. (See Use Case P1).	
3	PEV	Indicates to customer that binding has been successful and that the PEV will receive incentive rate, if applicable, upon charging.	
4	PEV	Begins charging based on customer-selected preferences. Charging may be delayed based upon customer preferences or grid reliability criteria (e.g., off-peak economy charging, demand response event underway, short, randomized charging delay to promote grid stability, etc.)	
5	EUMD	Records charging information and energy supplied to PEV for each charging session. Charging information includes PEV I.D., premises I.D., energy usage, and time stamp for each metering interval.	
6	EUMD	Communicates to ESCI the energy supplied to PEV for each charging session.	This communication could be on a periodic basis during charging, upon vehicle unplug from energy portal, or a combination of the two. See Issue 5.0 (Section 6)
7	ESCI	Communicates to utility the energy supplied to PEV for each charging session.	
8	Utility	Records each PEV charging session for generating bills and reporting to the customer account associated with this premises and PEV I.D.	

3.2 Primary Scenario: Customer connects PEV to energy portal at another premises and premises customer pays for energy usage

This scenario describes what happens when a customer plugs a PEV into another premises (not his own, but one serviced by the same utility), where the premises owner is responsible for the cost of energy delivered to the PEV charged at the premises.

<i>Triggering Event</i>	<i>Primary Actor</i>	<i>Pre-Condition</i>	<i>Post-Condition</i>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the steps</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
<i>The customer plugs a PEV into an energy portal.</i>	<i>PEV</i>	<i>Customer has enrolled a PEV with their home utility.</i>	<i>The utility has a record of energy purchased transactions related to the customer premises and the associated PEV I.D.</i>

3.2.1 Steps for this scenario

Describe the normal sequence of events required to complete the scenario.

<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
<i>#</i>	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	PEV	Connects to energy portal at another customer location within the utility service territory, and the customer at this location is willing to pay for charging the PEV.	PEV may display message communicating charging/billing options or information to the customer.
2	PEV and ESCI	Performs PEV binding and authentication process (see Use Case P1).	
3	PEV	Indicates to customer that binding has been successful and that the PEV will receive incentive rate, if applicable, upon charging.	

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<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
4	PEV	Begins charging based on customer-selected preferences. Charging may be delayed based upon customer preferences or grid reliability criteria (e.g., off-peak economy charging, demand response event underway, short, randomized charging delay to promote grid stability, etc.)	
5	EUMD	Records charging information and energy supplied to PEV for each charging session. Charging information includes PEV I.D., premises I.D., energy usage, and time stamp for each metering interval.	
6	EUMD	Communicates to ESCI the amount of energy supplied to PEV for each charging session.	This communication could be on a periodic basis during charging, upon vehicle unplug from energy portal, or a combination of the two. See Issue 5.0 (Section 6)
7	ESCI	Communicates to the utility the energy supplied to PEV I.D. for each charging session.	
8	Utility	Records each PEV charging session for generating bills and reporting to the customer account associated with the premises where the PEV was charged. The customer account associated with the PEV I.D. is not charged.	

3.3 Primary Scenario: Customer connects PEV to energy portal at another premises and PEV customer pays for energy use

This scenario describes what happens if the customer plugs their PEV into another premises (not his own, but serviced by the same utility), where the PEV operator is responsible for the cost of energy delivered to the PEV being charged at the premises.

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<i>Triggering Event</i>	<i>Primary Actor</i>	<i>Pre-Condition</i>	<i>Post-Condition</i>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the steps</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
<i>The customer plugs a PEV into an energy portal.</i>	<i>PEV</i>	<i>Customer has enrolled a PEV with their home utility.</i>	<i>The utility has a record of energy purchased transactions related to the customer premises and the associated PEV I.D.</i>

3.3.1 Steps for this scenario

Describe the normal sequence of events required to complete the scenario.

<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
<i>#</i>	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	PEV	Connects to energy portal at another customer location within the utility's service territory. PEV owner pays for charging.	PEV may display messages for the customer communicating information such as charging/billing options.
2	PEV and ESCI	Performs PEV binding and authentication process (see Use Case P1).	
3	PEV	Indicates to customer that binding has been successful and that they will receive incentive rate, if applicable, upon charging.	
4	PEV	Begins charging based on customer selected preferences. Charging may be delayed based upon customer preferences or grid reliability criteria (e.g., off-peak economy charging, demand response event underway, short, randomized charging delay to promote grid stability, etc.)	

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<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
5	EUMD	Records charging information and energy supplied to PEV for each charging session. Charging information includes PEV I.D., premises I.D., energy usage, and time stamp for each metering interval.	
6	EUMD	Communicates to ESCI the energy supplied to PEV for each charging session.	This communication could be on a periodic basis during charging, upon vehicle unplug from energy portal, or a combination of the two. See Issue 5.0 (Section 6)
7	ESCI	Communicates to utility the energy supplied to PEV for each charging session.	
8	Utility	Records each PEV charging session for generating bills and reporting to the customer account associated with this PEV I.D. Customer account associated with this premise will be credited for energy supplied for this charging session.	See Issue 8.0 (Section 6)

3.4 Primary Scenario: Customer connects PEV to energy portal at premises outside the enrolled utility's service territory

This scenario describes what happens if the customer plugs a PEV into premises other than their own, and it is not serviced by the same utility (i.e. roaming utility), where the PEV operator is responsible for the cost of energy delivered to the PEV charged at the premise.

<i>Triggering Event</i>	<i>Primary Actor</i>	<i>Pre-Condition</i>	<i>Post-Condition</i>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the steps</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
<i>The customer plugs a PEV into an energy portal.</i>	<i>PEV</i>	<i>Customer has enrolled PEV with home utility. Both home and foreign/roaming utility participate</i>	<i>The foreign/roaming utility and the clearinghouse have record of the energy purchased transactions</i>

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		<i>in inter-utility clearinghouse.</i>	<i>related to the customer premises, the PEV, customer and utility I.D.</i>
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3.4.1 Steps for this scenario

Describe the normal sequence of events required to complete the scenario.

Step #	Actor	Description of the Step	Additional Notes
#	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	PEV	Connects to energy portal at a location outside of the home utility service territory. PEV owner will pay for charging.	PEV may display messages for the customer communicating information such as charging/billing options.
2	PEV	Senses power to on-board charging unit and activates 'On Plug' state.	
3	PEV and ESCI	Initiate a secure communications session.	Implementation could have PEV or ESCI as initiator of session.
4	PEV	Transmits PEV I.D. to ESCI.	Unique PEV I.D. will ultimately support portability of charging, among other purposes.
5	ESCI	Maintains communications session and security between PEV and roaming utility. ESCI transmits request for validating PEV I.D. to roaming utility, including premises I.D.	
6	Roaming Utility	Checks PEV I.D. and premises I.D. against internal database. When not found (because PEV is registered with home utility), roaming utility forwards PEV I.D. and roaming utility I.D. to clearinghouse for verification.	

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<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
7	Clearinghouse	Checks PEV database for PEV I.D. and finds corresponding home utility I.D. and home utility account/premises I.D.	Underlying assumption is that PEV has been registered with home utility and that both utilities participate in the clearinghouse.
8	Clearinghouse	Transmits confirmed message to roaming utility, including PEV I.D., home utility I.D. and home utility account/premises I.D.	See Issue 10.0 (Section 6)
9	Roaming Utility	Transmits confirmed message via ESCI to EUMD indicating successful binding with premises ESCI.	
10	ESCI	Transmits confirmation message to PEV indicating successful communications binding of PEV to a roaming utility at the PEV program tariff rate. PEV indicates to customer that binding is successful and the customer will receive the incentive rate upon charging, if applicable.	
	PEV	Begins charging based on customer selected preferences. Charging may be delayed based upon customer preferences or grid reliability criteria (e.g., off-peak economy charging, demand response event underway, short, randomized charging delay to promote grid stability, etc.)	
11	EUMD	Records charging information and energy supplied to PEV for each charging session. Charging information includes PEV I.D., premises I.D., energy usage, and time stamp for each metering interval.	
12	EUMD	Communicates to ESCI energy supplied to PEV for each charging session.	This communication could be on a periodic basis during charging, upon vehicle unplug from energy portal, or a combination of the two. See Issue 5.0 (Section 6)
13	ESCI	Communicates to roaming utility energy supplied to PEV for each charging session.	

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<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
14	Roaming Utility	Records each PEV charging session for reporting to clearinghouse. Customer account associated with this roaming utility will be credited for energy supplied for this charging session.	
15	Roaming Utility	Forwards transaction to clearinghouse for energy supplied to PEV including PEV I.D., customer I.D., home utility I.D. and interval based charging session information.	
16	Clearinghouse	Receives energy charge transaction from roaming utility for posting charges to PEV operator's home utility customer account.	See Issue 8.0 (Section 6) See Issue 9.0 (Section 6)

3.5 Primary Scenario: Non-enrolled PEV (or customer with non-communicating PEV) connects to energy portal

This scenario describes what happens when an un-enrolled PEV communicates with local area network (e.g., LAN, HAN, PAN) or the customer has a PEV that cannot communicate with a specific utility's network.

<i>Triggering Event</i>	<i>Primary Actor</i>	<i>Pre-Condition</i>	<i>Post-Condition</i>
<i>Identify the name of the event that initiates the scenario</i>	<i>Identify the actor whose point-of-view is primarily used to describe the steps</i>	<i>Identify any pre-conditions or actor states necessary for the scenario to start</i>	<i>Identify the post-conditions or significant results required to complete the scenario</i>
<i>The customer plugs in the PEV into energy portal.</i>	<i>PEV</i>	<i>Customer has a PEV, but is not enrolled in a utility PEV program, has a non-communicating PEV, or both.</i>	<i>No communication session established with utility network or devices. PEV charges successfully with all energy charges accruing to charging premises account.</i>

3.5.1 Steps for this scenario

Describe the normal sequence of events that is required to complete the scenario.

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<i>Step #</i>	<i>Actor</i>	<i>Description of the Step</i>	<i>Additional Notes</i>
<i>#</i>	<i>What actor, either primary or secondary is responsible for the activity in this step?</i>	<i>Describe the actions that take place in this step. The step should be described in active, present tense.</i>	<i>Elaborate on any additional description or step value to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.</i>
1	PEV	Connects to energy portal at any customer location. This could be in the PEV operator's home utility service territory or in a foreign utility service territory.	
2	PEV	Senses power to on-board charging unit and activates 'On Plug' state.	
3	PEV and ESCI	If communications are enabled ESCI initiates a secure communications session.	Implementation could have PEV or ESCI as initiator of session. If PEV does not have communications capability or it is disabled, charging will commence with all energy charges accruing to premises customer at default rate for customer account.
4	PEV	Transmits PEV I.D. to ESCI	
5	Utility	Checks PEV and premises I.D. against internal database. If not found due to PEV roaming outside of home utility service area, utility forwards PEV I.D. to clearinghouse for verification.	
6	Utility and Clearinghouse	Neither utility nor clearinghouse has record of the PEV I.D.	Utility will have PEV I.D. of un-enrolled PEV, should it desire to identify it and contact operator regarding potential enrollment in utility program.
7	PEV	Begins charging based on customer selected preferences. All energy charges accrue to premises account.	

4. Requirements

Detail the Functional, Non-Functional and Business Requirements generated from the workshop in the tables below. If applicable list the associated use case scenario and step.

4.1 Functional Requirements

<i>Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
PEV shall be capable of plugging into EVSE enabled 120V or 240V AC energy portal to receive a charge of electric energy.	1,2,3,4,5	1
Premises support charging multiple PEVs simultaneously for home PEV and guest PEV.	1,2,3,4,5	1
PEV shall be able to charge upon plugging into EVSE enabled 120V or 240V AC energy portal with or without communications established with utility.	1,2,3 4 5	4 10 7
The PEV shall be capable of sensing 'on plug' state, participating in communications with ESCI, and proceeding with charging according to customer selected preference.	4,5	2
The ESCI shall exist at the customer premises and be capable of communicating to the utility and can communicate to the PEV to facilitate exchange of charging session information.	1,2,3 4,5	2 3
Vehicle shall communicate with the utility through an ESCI.	1,2,3	3,4
PEV shall have a unique I.D., which can be stored within and communicated from a PEV.	1,2,3 4,5	5 4
The PEV shall be capable of providing to the ESCI its unique PEV I.D. upon initiation of a communications session between the PEV and ESCI.	4,5	4
The utility shall maintain information on all customers and PEV enrolled in the PEV programs, associated PEV, customer and premises I.D.	4 5	6 5
Utility shall be able to determine customers/premises not enrolled in PEV program.	5	6

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<i>Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
Utility shall establish message and data interface exchange mechanisms with clearinghouse for verification of roaming PEV.	4	6,8
	5	5
Utility shall be able to verify that usage attributable to PEV charging is sourced from the same customer/premises that provide the ESCI for PEV-to-utility communications (e.g., load correlation to ESCI communications).	1,2,3	2
	4	5
	5	3
PEV shall be capable of receiving a confirmation message from utility via ESCI, establishing a valid charging session. This indication in turn can be made available to the customer to indicate that communications sessions have been established.	1,2,3	3
	4	10
An EUMD shall be required to discretely measure usage provided for PEV charging.	1,2,3,	5
	4	11
EUMD function shall be inclusively located anywhere in a zone from the PEV and the branch circuit panel connection.	1,2,3	5
	4	11
EUMD shall be capable of metering energy supplied to the PEV for each metering interval according to the tariff.	1,2,3	5
	4	11
EUMD shall be capable of recording charging session information (e.g., PEV I.D., premises I.D.).	1,2,3	5
	4	11
PEV EUMD shall be compatible with the utility, auto manufacturer, and state weights and measures body (specific standards to be determined).	1,2,3	5
	4	11
EUMD shall allow for remote configuration of energy measurement interval length.	1,2,3	5
	4	11
EUMD shall be capable of reporting all PEV charging session information and energy usage for PEV charging to the ESCI.	1,2,3	6
	4	12
EUMD shall be capable of communicating with the utility via the ESCI.	1,2,3	6
	4	12

Edison SmartConnect Program P2 – Customer Connects Plug-In Electric Vehicle (PEV) to Premises Energy Portal

<i>Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
PEV, EUMD, and ESCI shall establish secure communications links.	1,2,3 4 5	2 5 3
ESCI shall be capable of reporting all PEV charging session's information and energy usage for PEV charging to the utility.	1,2,3 4	7 13
The utility shall accurately bill the correct customer account for the total kWh supplied during a predetermined billing period to a PEV, according to the selected rate tariff, when the PEV customer and the local premises customer are the same.	1	8
The utility shall accurately bill the correct local premises customer account for the total kWh supplied during a predetermined billing period to a PEV, according to the selected rate tariff, when the PEV customer and the charging premises customer are NOT the same and the charging premises customer has been designated for PEV usage charges.	2	8
The utility shall accurately credit the correct local premises customer account for the total kWh supplied during a predetermined billing period to a PEV, according to the selected rate tariff, when the PEV customer and the local premises customer are NOT the same and the PEV customer has been designated for PEV usage charges. Utility shall handle billing PEV usage to utility account associated to PEV I.D.	3	8
The utility shall accurately credit the correct local premises customer account for the total kWh supplied during a predetermined billing period to a PEV, according to the selected rate tariff, when the PEV customer and the local premises customer are NOT the same and the PEV customer has been designated for PEV usage charges.	4	14
In the foreign/roaming utility charging case, a clearinghouse shall handle billing transactions to home utility account associated to PEV I.D. and settling charges across utilities.	4	16
The clearinghouse shall store the relationship between PEV, home utility, and home utility account I.D.	4 5	7 6
If ESCI communications cannot be established between PEV and utility within a configurable period of time after 'on plug' state, charging will proceed (according to customer preferences) with all charges accruing to premises customer account according to that customer's regular utility rate.	1,2,3	2
	4,5	3

Edison SmartConnect Program P2 – Customer Connects Plug-In Electric Vehicle (PEV) to Premises Energy Portal

<i>Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
ESCI shall be able to provide the premises I.D. to the utility (along with PEV I.D. provided by PEV) for validation/verification.	4	5
	5	4
Utility shall have the means to determine whether PEV operator/customer or premises customer accrues energy charges when premises customer and PEV operator/customer are not the same. (Must be considered in enrollment scenario).	2,3	1

4.2 Non-Functional Requirements

<i>Non-Functional Requirements</i>	<i>Associated Scenario # (if applicable)</i>	<i>Associated Step # (if applicable)</i>
Time shall be maintained by each device in the system to UTC with 1 second resolution.	1,2,3	5
	4	11
EUMD shall record interval data configurable for interval lengths between 1 and 60 minutes inclusive.	1,2,3	5
	4	11
PEV shall initiate communications session before initiating charging.	1,2,3	2
	4,5	3
PEV shall wait a minimum time (e.g., 1 minute) allowing verification/validation before charging activation.	1,2,3	4
	4	10
	5	7
PEV shall begin charging with randomization at configured start time in charging preferences preventing all PEVs from adding load to the system at exactly the start of off-peak charging.	1,2,3	4
	4	10
	5	7

5. Use Case Models (optional)

This section is used by the architecture team to detail information exchange, actor interactions and sequence diagrams.

5.1 Information Exchange

For each scenario detail the information exchanged in each step.

Scenario #	Step #, Step Name	Information Producer	Information Receiver	Name of information exchanged
#	Name of the step for this scenario.	What actors are primarily responsible for producing the information?	What actors are primarily responsible for receiving the information?	Describe the information being exchanged
1,2,3 5	<u>2</u> <u>4</u>	PEV	ESCI	PEV I.D., Premises I.D., Authorization Success Indicator
4	<u>5</u>	ESCI	Utility	PEV I.D., Premises I.D.
4 5	<u>6</u> <u>5</u>	Roaming Utility	Clearinghouse	<ul style="list-style-type: none"> • PEV I.D. • Premises I.D. • Foreign/Roaming Utility I.D.
4	<u>8</u>	Clearinghouse	Roaming Utility	<ul style="list-style-type: none"> • Verification of PEV I.D. • Verification of Utility I.D. • Home Utility I.D. • Home Utility Account I.D. • Meter Interval
4	<u>9</u>	Roaming Utility	ESCI and EUMD	For each 'On Plug' state session and once-a-day <ul style="list-style-type: none"> • Verification of PEV I.D. / Premises I.D. • Meter Interval

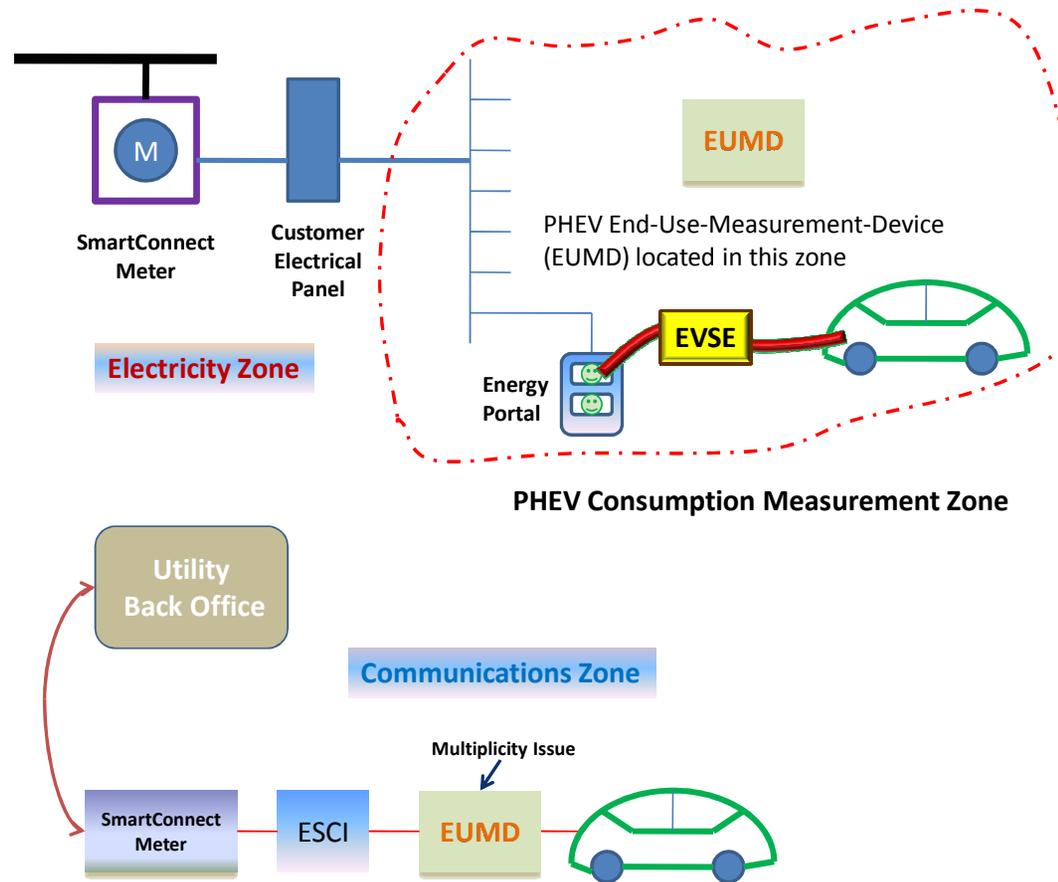
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Scenario #	Step #, Step Name	Information Producer	Information Receiver	Name of information exchanged
1,2,3 4	6 12	EMUD	ESCI	Charging session event message <ul style="list-style-type: none"> • PEV I.D. • Premise I.D. • Metered energy supplied by each metering interval
1,2,3 4	7 13	ESCI	Utility	Charging session event message <ul style="list-style-type: none"> • PEV I.D. • Premises I.D. • Metered energy supplied by each metering interval
4	15	Utility	Clearinghouse	Charging session event message <ul style="list-style-type: none"> • PEV I.D. • Premises I.D. • Customer I.D. • Utility I.D. • Metered energy supplied by each metering interval

5.2 Diagrams

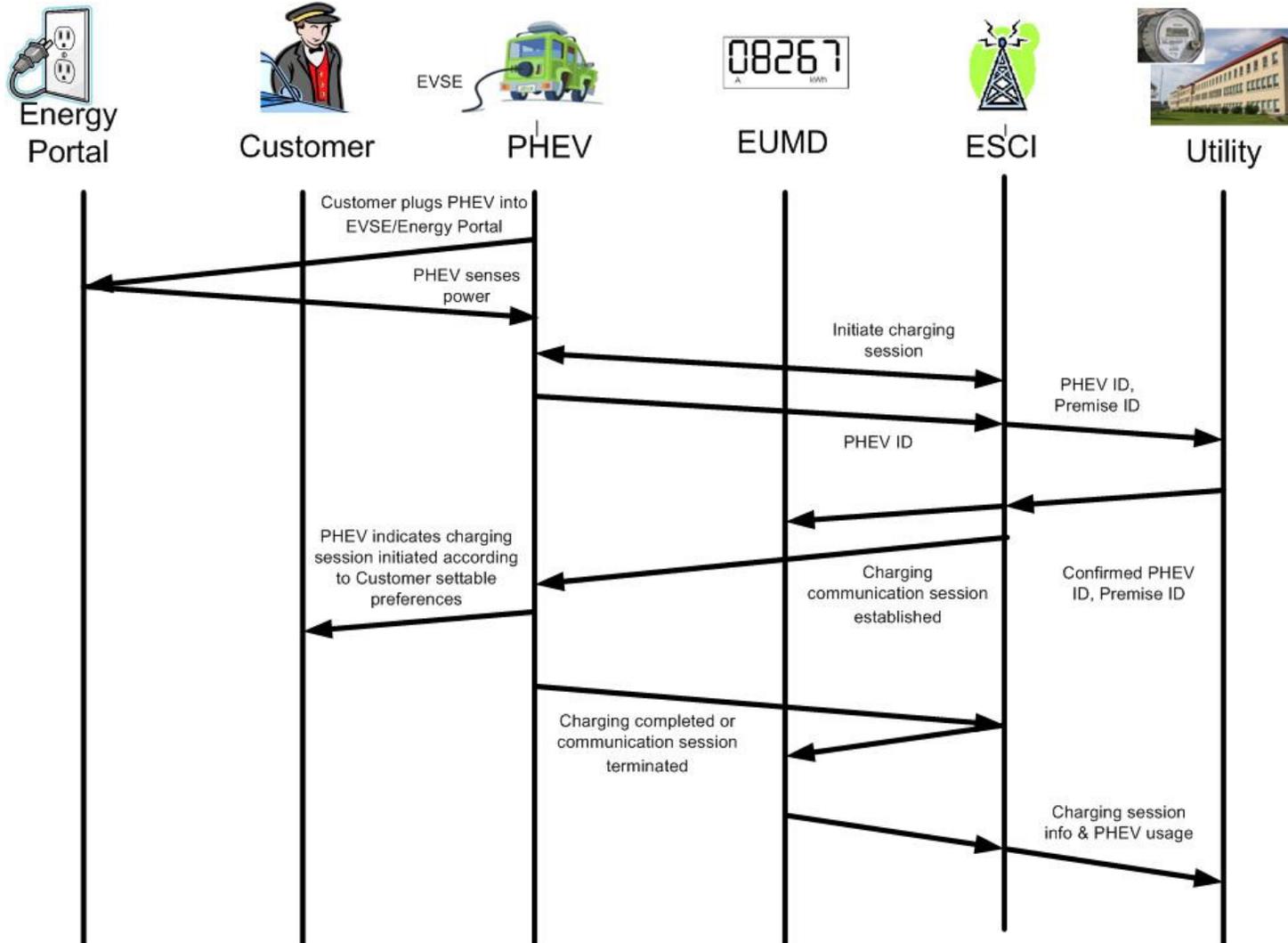
The architecture team shall use this section to develop an interaction diagram that graphically describes the step-by-step actor-system interactions for all scenarios. The diagrams shall use standard UML notation. Additionally, sequence diagrams may be developed to help describe complex event flows.

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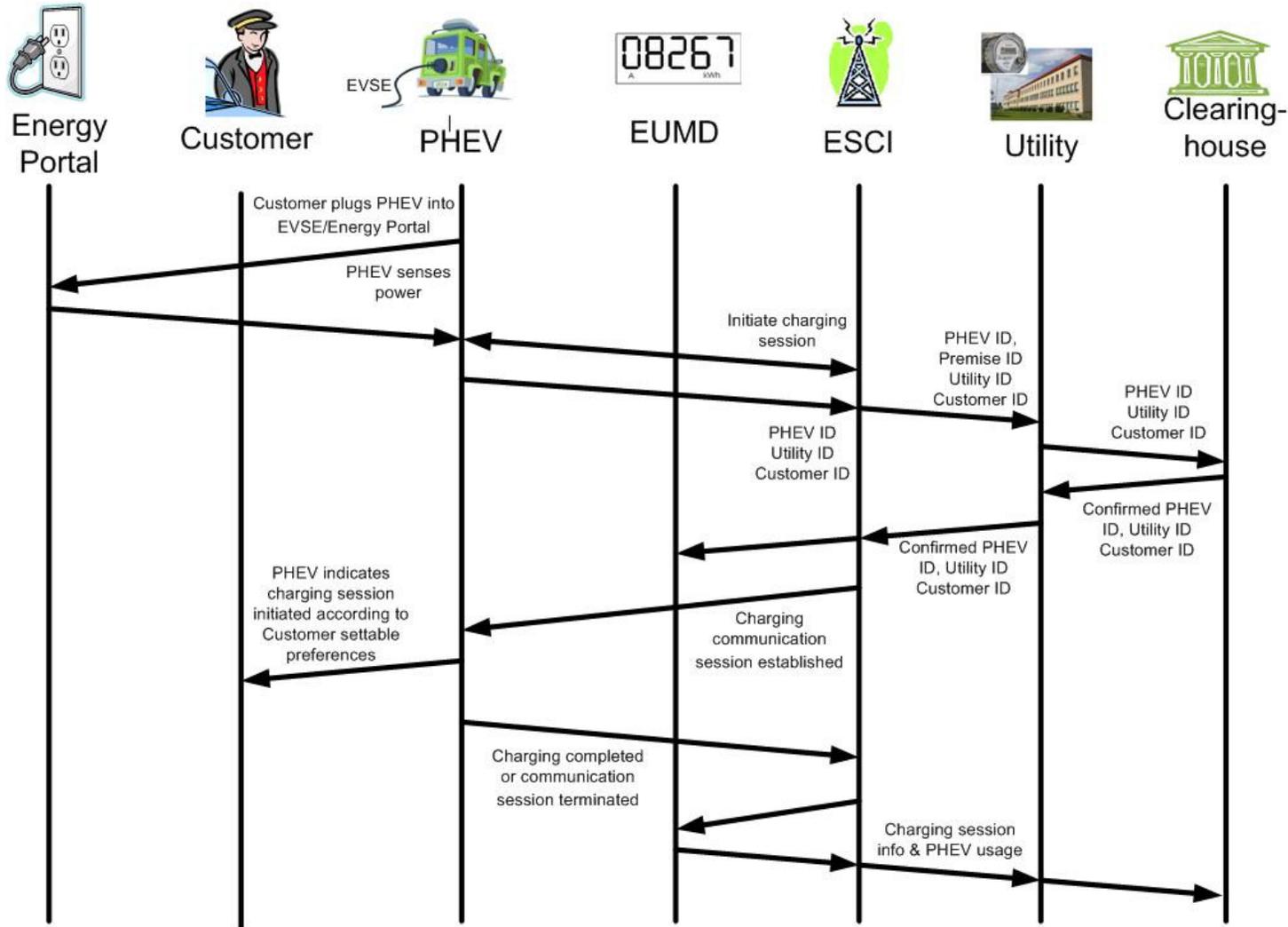


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5.2.1 Sequence Diagram: Scenarios 1, 2, 3



5.2.2 Sequence Diagram: Scenario 4



6. Use Case Issues

Capture any issues with the use case. Specifically, these are unresolved issues that help the use case reader understand the constraints or unresolved factors that have an impact of the use case scenarios and their realization.

<i>Issue</i>
<i>Describe the issue as well as any potential impacts to the use case.</i>
5.0 - EUMD communicates energy supplied to PEV to ESCI for each charging session. A question arises: What triggers or invokes this communication session? Does this event get triggered upon the battery completing a full charge? Does this happen with termination of charge and when the PEV unplugs? If the session does not end immediately, does the session resume next time a PEV charges in and can communicate to an ESCI?
6.0 – Concern expressed about the viability of implementing a billing system for Scenarios 2 and 3 that keep track of usage for PEV charging at a non-PEV operator/customer premises and charges the PEV customer account and credits the premises customer account correctly.
7.0 – Need to determine what happens when communications are unsuccessful between PEV and utility. This may be an issue in the case of roaming charging. Assumption is that no communications, energy charges would accrue to premises account at the default utility rate for that account (i.e. no incentive rates). Customers would not receive notification of successful binding/communications sessions in this case.
8.0 – For home or foreign utility roaming, need to consider what rates PEV operator would pay for usage outside of home premises, especially in a tiered rate environment. For example, would non-home premises PEV usage count against (and be charged at rates for) PEV operator’s home premises baseline, charging premises customer’s baseline, or neither?
9.0 – For foreign utility roaming, need to consider what rates PEV operator should pay—home utility’s rates, roaming utilities rates, special roaming rates, etc? Answer may be different depending on whether home or foreign utility has the higher energy prices. This would affect how clearinghouse accomplishes cross-utility settlement.
10.0 – Regarding the cross-utility clearinghouse for PEVs, further consideration needs to be taken to determine whether PEV/customer I.D. information is actually stored at the clearinghouse, or if it is simply a facilitator of information exchange between utilities that allows for rapid, automated account validation/acknowledgement.

7. Glossary

Insert the terms and definitions relevant to this use case. Please ensure that any glossary item added to this list should be included in the global glossary to ensure consistency between use cases.

Glossary	
Term	Definition
Rate tariff	Energy cost schedule to customer. Can be time-of-day, flat rate, seasonal rate, critical peak price rate, etc.
PEV	Plug-in Electric Vehicle. Includes all vehicles that have ability to receive electrical energy from the utility.
EUMD	End Use Measurement Device used to assess revenue.
ESCI	Energy Services Communication Interface
Charging	Act of electrically charging a battery on-board a PEV or all electric vehicle.

8. References

Reference any prior work (intellectual property of companies or individuals) used in the preparation of this use case.

9. Bibliography (optional)

Provide a list of related reading, standards, etc. that the use case reader may find helpful.